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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT INVESTIGATIONS

FOREST INSECT SURVEY REPORT, SEASON OF 1946

THE BURNEY AREA, SHASTA COUNTY, CALIFORNIA

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INTRODUCTION

The objectives of a forest insect survey are to detect, appraise, and evaluate the importance of insect activity in a stand of timber. An annual survey is necessary in order that incipient conditions of upward trends and possible epidemic loss do not escape notice. Accurate and up-to-date information on insect populations and trends in loss is essential for recommendations of proper methods for control.

The Burney Area is comprised of approximately 250,000 acres of timbered lands in Shasta County, California, and is under the joint administration and protection of the U. S. Forest Service and the California State Division of Forestry. It is estimated that approximately 2½ billion board feet of pine timber remains on 173,900 acres of virgin lands in this timbered basin.

Losses resulting from forest insect pests in this area during the past decade have averaged about 0.64 percent of the merchantable stand volume, or roughly 21⅓ million board feet every year. Of this total annual loss, 16 million board feet has been pine and 5⅓ million board feet white fir. The protection of the timber in the Burney Area against undue loss resulting from attacks by bark beetles is highly important in order to maintain a continuous supply of material for the saw mills and prosperity to the expanded communities related to the production of lumber in this area.

SURVEY METHODS

The yearly appraisal of forest insect activity in the Burney Area has been accomplished by recording the number and sizes of trees which were killed on established sample plots scattered throughout the area. On many of these plots, loss data are obtained by traversing the sample area by foot. Loss measurements on other plots are made by sampling along known distances of roads, or by general reconnaissance. The current insect loss survey was conducted during November 1946 by roadside and sample plot measurements. The writers were assisted in this work with personnel furnished by the California State Division of Forestry, the U. S. Forest Service, and the Fruit Growers Supply Company. The intensive survey of the sample plots amounted to a 4.9 percent cruise of the entire area at a total cost of $1,534.20. The location of sample plots on the respective entomological units are shown on the appended map, Figure 2.

SURVEY DATA OBTAINED

During 1938 Johnson (3) made a sample cruise of the Burney Area as a part of the inventory of forest insect hazard of "eastside" pine stands. In 1939 an insect loss survey was made of the several entomological units that were established by the inventory of hazard and a report was issued of conditions of loss that year (1). Despite work on various forest insect problems, surveys, and control, which have been conducted since 1939, there have been no reports issued of conditions of loss for the Burney Area as a whole. It is the purpose of this report to review the conditions and trends of loss since 1937, to give an account of the current infestation, and the results of control work which was undertaken in 1946.

(A) Insects Involved in the Infestation

Several forest insect species are involved in the pine infestation in the Burney Area. Two species of Ips engraver beetles (Ips confusus Lec. and I. oregoni Eichh.) have caused considerable loss in pole-sized trees and have partially killed many larger trees in the past three years. The scattering of logging operations throughout portions of the Burney Area in recent years has been considered responsible for the large populations of Ips beetles and their damage as mentioned above. The engraver beetles were able to breed and build up large populations in slash created by logging. Upon emergence from the slash, new broods of beetles attacked and killed green trees and poles when slash was no longer available as host material. In many instances, the engraver beetles killed only the upper portions of the larger trees.

The western pine beetle (Dendroctonus brevicomis Lec.) is the insect responsible primarily for the killing of most merchantable-sized trees. Under endemic conditions, this insect shows definite preference in attack for over-mature and decadent trees. During epidemic conditions, trees of any age or vigor class might be attacked and killed. Since 1943, the western pine beetle has increased in numbers by virtue of an abundance of highly susceptible trees in the stand. The green portions of the many trees partially killed by the engraver beetles gave impetus to the increased loss attributable to the western pine beetle since the Ips epidemic in 1944.

The California flathead borer (Melanophila californica Van Dyke) is often found in association with other cambium-mining insects in infested trees. In some cases, this insect is the sole agent responsible for the death of the tree, but generally, attacks by this insect are only fore-runners of lethal attacks by other bark-boring insects.

(B) Trend of Infestation

The trend of loss in pine on the Burney Area as a result of attack by the tree-killing insects as mentioned above is shown in Figure 1. It will be noted from the Figure that the trend of loss was downward from the peak reached in 1940 until 1943 when the record again showed an increase.

During 1943, aggressive infestations by Ips engraver beetles was noted over much of the area and this infestation, together with increased activity by the western pine beetle, had become so severe in portions of the area by 1944 that direct action was undertaken early in 1945 to combat this loss. This program of control was considered as highly successful and the objectives of the project were fulfilled. However, the ultimate aim in reducing bark beetle damage throughout the Burney Area was long term protection through forest management. Sanitation-salvage logging was planned for the area of high insect hazard and recommendations were made to apply indirect control to avoid further western pine beetle damage by proceeding with sanitation-salvage logging on the Burney Flat Unit as rapidly as possible.

(C) Conditions of Loss in 1945 and 1946

The estimated virgin pine timber killed in 1945 and 1946 by bark beetles in the Burney Area is given in Table 2. The measured loss on established sample plots for 1945 is given in Table 1. It will be noted from Table 2 that the loss in 1945 for the area as a whole averaged 91 board feet per acre, or 0.62 percent of the merchantable green stand. In 1946 the record shows a slight increase, averaging 94 board feet per acre or 0.64 percent of the green stand. It is expected that the total loss for 1946 will total slightly more than 100 board feet per acre when additional killed trees which were not evidenced during the fall survey are later cruised and recorded.

The greatest percentage loss increase in 1946 was noted in the Thousand Lakes Unit. Losses in the northern part of this unit (colored yellow on the attached map, Figure 3) are estimated at 1.0 percent of the green stand volume, or 179 board feet per acre. This area of high loss extends from Cornas Lake on the east to Burney Springs on the west and is generally bounded by the 4,800 foot contour. This area is principally pure ponderosa and Jeffrey pine with only a small percentage of white fir in the stand. Another area of high local loss in 1946 occurs in a portion of the Big Springs Unit south of Old Station. The current loss in this area (colored yellow on attached map, Figure 3) is expected to exceed 150 board feet per acre. Both of these local areas contain a high percentage of overmature trees of high risk to bark beetle attack. The volume of the average tree killed during 1946 in both of these local areas of high loss was about 2,000 board feet which represents a creaming off of the trees of high value in both areas.

RESULTS OF CONTROL WORK IN 1945 AND 1946

During 1945 a program of control was undertaken in the Burney Area to combat an epidemic infestation of bark beetles which had developed from slashings left by scattered logging in the area. The control work of that year was successful and very effective in reducing loss caused by certain of the tree-killing species (2). However, because of the infestation of western pine beetle which persisted in portions of the Burney Flat Unit, control was again undertaken in 1946 to prevent additional loss and maintain the benefits obtained the previous year until the entire area could be treated by sanitation-salvage methods.

Contrary somewhat from the original recommendations, three separate measures of control were used in the program during 1946. Fell-peel-burn methods were employed on 8,140 acres which had been treated in a similar manner during 1945. High risk trees were removed from 2,200 acres which had not been given direct control treatment previously, and on another area, 780 acres were given supplemental protection in addition to the removal of high risk trees by a peeling and burning of infested tops, breaks, and cull logs. A comparison of 1945 and 1946 losses on the areas treated by the three separate control methods is given in Table 3.

Table 3.

Comparison of Pine Losses in 1945 and 1946 on Areas Treated by Three Methods of Control.

Status of Sample	Acres in Sample	PINE LOSS 1945 No of Trees	PINE LOSS 1945 Volume bm	PINE LOSS 1945 Volume per Ac.	PINE LOSS 1946 No of Trees	PINE LOSS 1946 Volume bm	PINE LOSS 1946 Volume per Ac.	Ratio '46/'45
Fell-peel-burn control	2,588	158	146,600	56.6	132	126,310	48.8	0.86
Sanitation-salvage	1,208	174	153,620	127.2	47	23,250	19.2	0.15
S-salvage plus peel-burn of tops, etc.	676	100	88,070	130.3	16	12,390	18.3	0.14
Virgin Areas	1,826	142	119,240	65.3	78	82,080	45.0	0.69

An appraisal of the control measures used against the 1945 infestation has shown varying results. From the above Table it will be noted that on the area treated by direct fell-peel-burn methods, current losses are slightly above the record obtained on the untreated virgin stands and that the benefits of the 1946 control in this area only prevented increased loss.

Where high risk trees were removed through sanitation-salvage logging as an indirect method of combatting the infestation, and despite the absence of previous control of any kind, current loss dropped to an average of 19.2 board feet per acre, or approximately one-third the loss on surrounding virgin stands. The additional work in peeling and burning infested tops, breaks, and cull logs on the area where this type of control supplemented the sanitation-salvage operation resulted in very little benefits in further reducing infestations over sanitation-salvage logging alone. It will be noted that the record of loss between both areas treated by sanitation-salvage methods differs by only 1 board foot per acre.

CONCLUSIONS AND RECOMMENDATIONS

In view of the current high loss in portions of the Burney Area, and with regard to the benefits derived from the control against the 1945 infestation, it is recommended that sanitation-salvage operations be continued as the most satisfactory method of control for the area. It is to be urged that the logging of high risk trees be directed into the north half of the Burney Flat Unit as soon as possible as it is felt that the expenditures for fell-peel-burn control during the past two years can best be protected by proceeding immediately with light sanitation-salvage logging. Priority in the selection of areas to be treated subsequent to the control on the Burney Flat Unit would be (1) the local area of high current loss to the south of Old Station in the Big Springs Unit, and (2) the area as indicated in the Thousand Lakes Unit. Only a small amount of direct fell-peel-burn control work is needed against a few scattered group infestations outside the area which can be reached by logging.

REFERENCES

1. Hall, R. C. Preliminary report. Forest insect survey of Burney area. Season of 1939. Unpublished report. Forest Insect Laboratory, Berkeley, California. October 31, 1939.

2. _____ Accomplishments of the Burney-McCloud insect control project during 1945. Station report. Forest Insect Laboratory. Berkeley, Calif. February 25, 1946

3. Miller, J. M., K. A. Salman, and P. C. Johnson. Bark beetle hazards in the pine stands of northeastern California. Multilithed report. Forest Insect Laboratory. Berkeley, California. May 15, 1941

Table 1.

Pine timber killed by bark beetles on virgin sample plots in 1945
Burney Area, Shasta County, California

Entomological Unit	SAMPLE PLOTS Number	Timb'd Acreage	PINE STAND Hazard Rating	Tree Spp.	Volume M.b.m.	TIMBER KILLED IN 1945 No. of Trees	Volume b.m.	Volume per ac.	% of Stand
Burney Flat	BD-1	320	III - IV	PP	2,864	22	18,840	59	0.66
	BD-2	280	IV	PP	2,481	25	21,330	76	0.86
	BD-3	56	IV	PP	496	4	5,310	95	1.07
	BD-4	128	III - IV	PP	1,145	8	7,540	59	0.66
	BD-5	112	III - IV	PP	1,002	8	4,050	36	0.40
	BD-6	32	IV	PP	284	3	1,810	57	0.64
	BD-7	244	IV	PP	2,162	20	21,130	87	0.98
	BD-8	32	III	PP	289	4	3,810	119	1.32
	BD-9	180	III - IV	PP	1,611	35	26,550	148	1.64
	BR-4,6,7	60	IV	PP	532	3	5,190	87	0.97
	BR-9,12	40	III	PP	361	3	2,430	61	0.67
	SR-4	240	III - IV	PP	2,148	10	12,310	51	0.57
	SR-5	320	III	PP	2,891	15	10,820	34	0.37
	SR-6	320	III	PP	2,891	17	16,900	53	0.58
	SR-9	290	III	PP	2,620	9	4,350	15	0.17
	SR-10	320	IV	PP	2,836	19	14,080	44	0.50
	SR-11	320	III	PP	2,620	21	30,750	96	1.17
	SR-12	320	III - IV	PP	2,864	15	9,950	31	0.35
	SR-13	320	IV	PP	2,836	13	19,420	61	0.68
	SR-14	320	IV	PP	2,836	17	11,390	36	0.40
	Total	4,254		PP	37,769	271	247,960		
	Average			PP				58	0.66

Table 1. (Continued)

Entomological Unit	SAMPLE PLOTS Number	Timb'd Acreage	PINE STAND Hazard Rating	Tree Spp.	Volume M.b.m.	TIMBER KILLED IN 1945 No. of Trees	Volume b.m.	Volume per ac.	% of Stand
Goose Valley	RD-21	104	II	PP	903	1	6,210	60	0.69
	RD-22	80	II	PP	694	1	4,310	54	0.62
	RD-23	72	II	PP	625	1	2,500	35	0.40
	RP-3,5,14	60	II	PP	521	2	10,740	179	2.06
	RP-8	20	III	PP	287	2	2,390	120	0.83
	Total	336		PP	3,030	7	26,150		
	Average			PP				78	0.86
Dry Lake	RD-9	68	III - IV	PP	703	6	4,170	61	0.59
	RD-10	112	II	PP	1,871	3	13,980	125	0.75
	RD-11	248	III	PP	2,565	5	19,460	78	0.76
	RD-12	304	II - III	PP	4,112	6	27,230	90	0.66
	Total	732		PP	9,251	20	64,840		
	Average			PP				89	0.70
Doyle Butte	RD-9	112	III	PP	1,200	20	16,890	151	1.41
	RP-13,16	40	III	PP	429	3	2,930	73	0.68
	RP-15,17	30	IV	PP	206	3	2,200	73	1.07
	Total	182		PP	1,835	26	22,020		
	Average			PP				121	1.20

Table 1. (Continued)

Entomological Unit	SAMPLE PLOTS Number	Timb'd Acreage	PINE STAND Hazard Rating	Tree Spp.	Volume M.b.m.	TIMBER KILLED IN 1945 No. of Trees	Volume b.m.	Volume per ac.	% of Stand
Thousand Lakes	RD-13	272	III	PP	2,915	18	17,760	65	0.61
	RD-14	160	III	PP	1,715	3	3,660	23	0.21
	RD-15	216	III	PP	2,315	5	18,670	86	0.81
	RD-15A	200	III	PP	2,144	11	38,710	194	1.81
	RD-16	120	III	PP	1,286	None	None	None	None
	RP-19,20,22	60	III	PP	642	4	12,030	201	1.87
	RP-21	20	II	PP	346	1	2,930	146	0.85
	Total	1048		PP	11,363	42	93,760		
	Average			PP				89	0.83
Hat Creek	RD-18A	416	III	PP	4,459	18	18,560	45	0.42
	RP-18,23,24	60	IV	PP	582	5	8,410	140	1.45
	RP-25	20	II	PP	282	None	None	None	None
	RP-26,27	40	III	PP	428	None	None	None	None
	Total	536		PP	5,751	23	26,970		
	Average			PP				50	0.47
Big Springs	RD-18	320	III	PP	4,170	5	5,270	16	0.13
	RD-19	320	III	PP	4,170	20	54,340	170	1.30
	RD-19A	344	III	PP	4,483	18	44,010	128	0.98
	RD-20	240	III	PP	3,127	10	29,630	123	0.95
	RP-28,32,34,36	140	III	PP	1,827	5	22,580	161	1.24
	RP-33,35,37,38	80	II	PP	908	7	15,610	195	1.72
	Total	1,444		PP	18,685	65	171,440		
	Average			PP				119	0.92
Total for Reporting Area		8,532		PP		454	653,140		
Average for Reporting Area				PP				77	0.74

Table 2.

Estimated virgin pine timber killed in 1945 and 1946 by bark beetles in the Burney Area. Shasta and Siskiyou Counties, California.

Unit Area	Timb'd Acres (Virgin) 1/1/46	Pine Timber Resources (Vol)		ESTIMATED PINE TIMBER LOSSES							
				Year of 1945				Year of 1946			
		M bm	bm/ac	No.Tr.	M bm	bm/ac	% Stand	No.Tr.	M bm	bm/ac	% Stand
Burney Flat	21,770	190,315	8,740	1,644	1,785	82	0.94	1,263	1,197	55	0.63
Goose Valley	25,850	425,122	16,450	485	2,327	90	0.55	386	1,939	75	0.46
Dry Lake	20,390	378,511	18,560	431	1,855	91	0.49	648	2,121	104	0.56
Doyle Butte	13,510	157,335	11,650	1,302	1,081	80	0.69	1,210	1,148	85	0.73
Thousand Lakes	36,300	650,097	17,911	1,419	3,412	94	0.52	2,485	4,901	135	0.75
Hat Creek	12,140	143,162	11,790	562	607	50	0.42	554	910	75	0.64
Big Springs	43,945	617,146	14,044	1,791	4,754	119	0.77	2,074	4,355	109	0.71
Total	173,905	2,561,688		7,634	15,821			8,620	16,571		
Average			14,730			91	0.62			95	0.64

FIGURE 1

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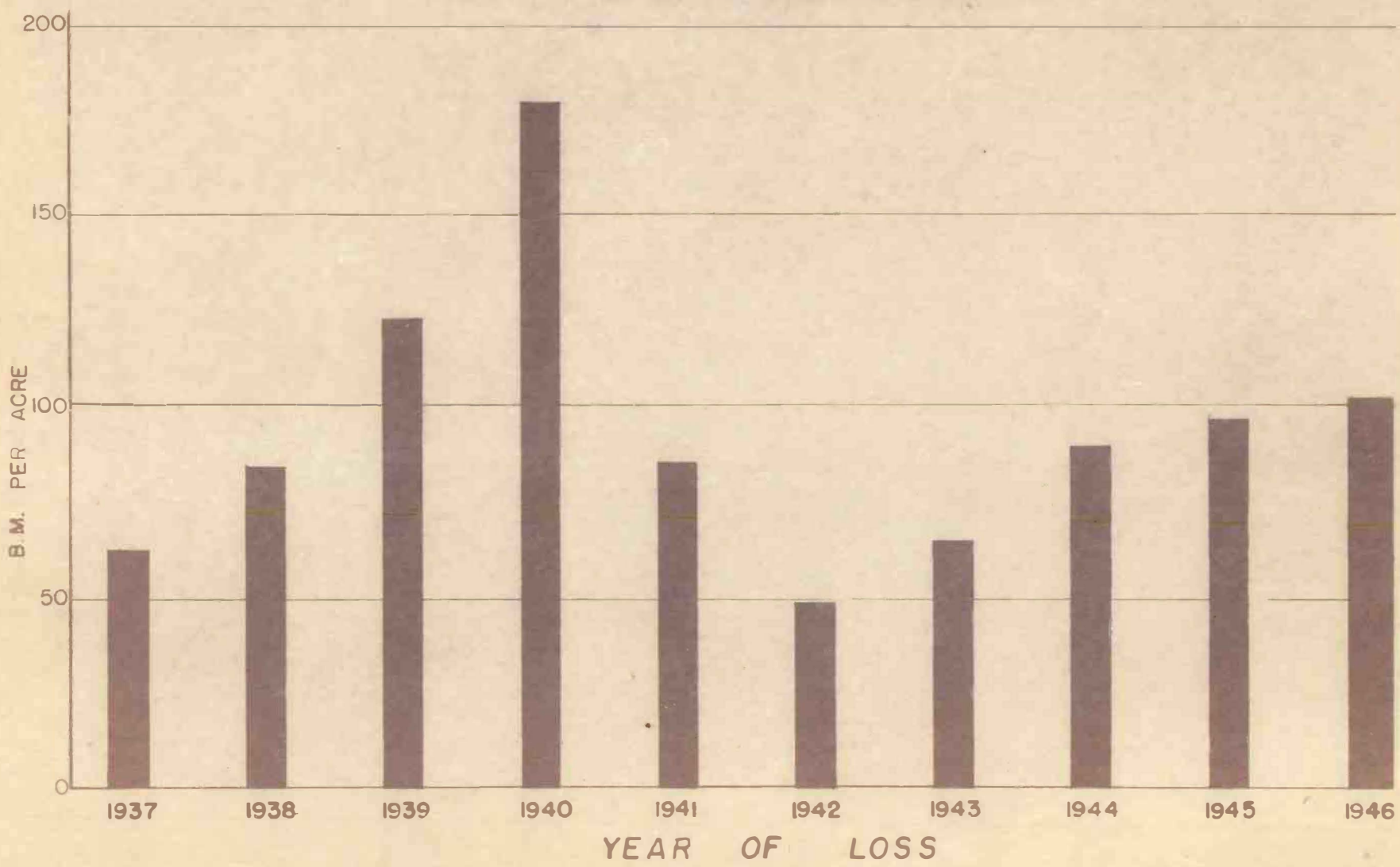
INSECT LOSSES

BURNEY AREA, SHASTA & SISKIYOU CO., CALIF.

1937-1946

ANNUAL B.M. LOSS PER ACRE



R.2 E. R.3E. R.4E.

T. 37 N.

T. 36 N.

T. 35 N.

T. 34 N.

T. 33 N.

T. 32 N.

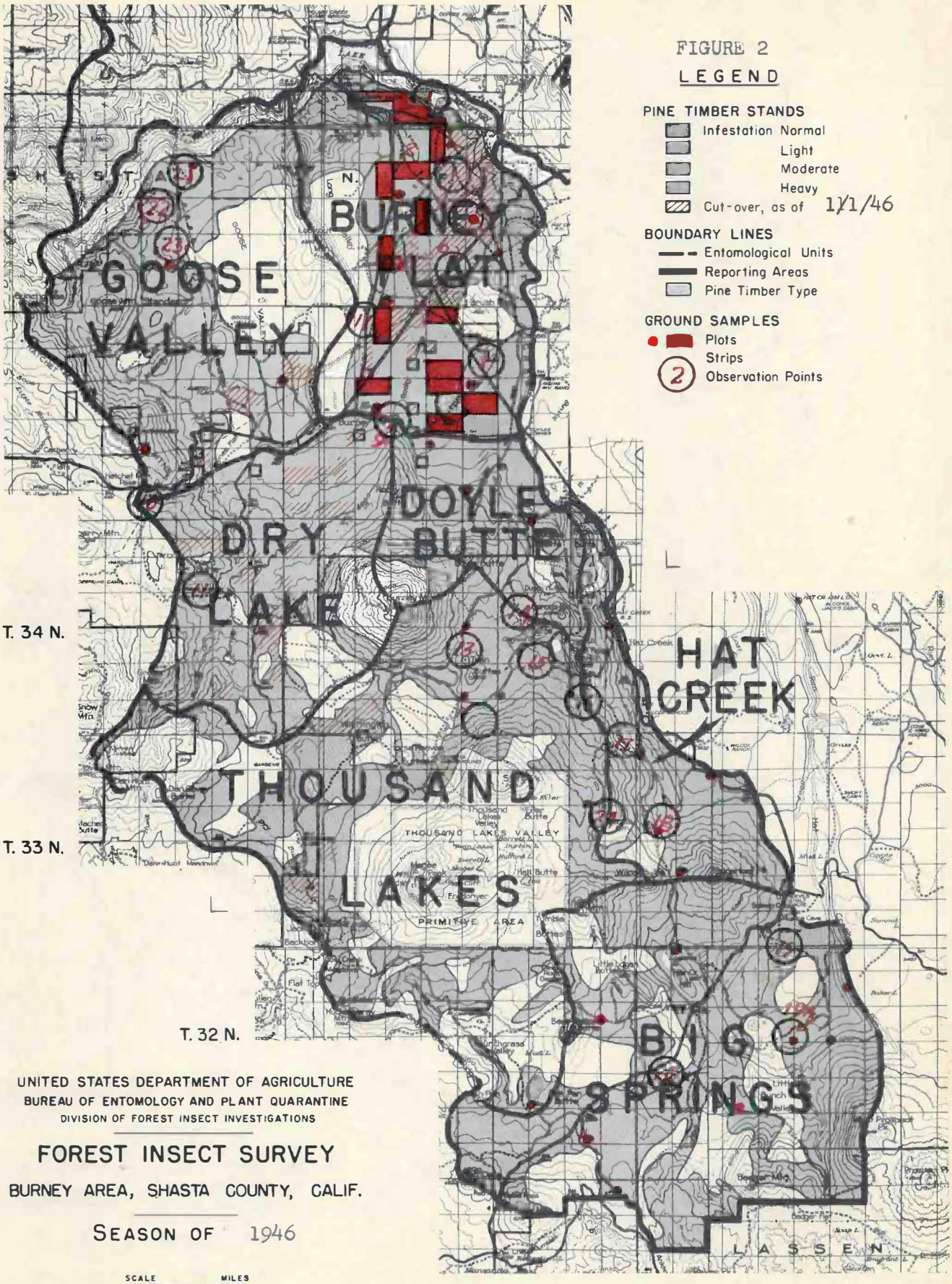


FIGURE 2

LEGEND

PINE TIMBER STANDS

- Infestation Normal
- Light
- Moderate
- Heavy
- Cut-over, as of 1/1/46

BOUNDARY LINES

- Entomological Units
- Reporting Areas
- Pine Timber Type

GROUND SAMPLES

- Plots
- Strips
- (2) Observation Points

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FOREST INSECT SURVEY

BURNEY AREA, SHASTA COUNTY, CALIF.

SEASON OF 1946

SCALE MILES
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